AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions and listings of claims in the application:

1. (Previously Presented) An optical information recording medium comprising:

a transparent substrate having a first surface and a second surface;

a recording layer that contains regions of differing optical density and is arranged on the first surface of the transparent substrate,

wherein

a hologram is recorded in the recording layer when a signal light and a reference light are incident from an incident side opposite to the transparent substrate,

a region in the recording layer, in which the hologram is recorded, is conical, and

the optical density of the recording layer corresponding to the signal light decreases from the incident side toward the transparent substrate; and

a reflection layer arranged on the second surface of the transparent substrate.

2. (Cancelled)

3. (Previously Presented) The optical information recording medium according to claim 1, wherein

the recording layer includes a high optical density layer and a low optical density layer corresponding to the signal light, and

the high optical density layer is arranged on the incident side relative to the low optical density layer.

4. - 5. (Cancelled)

6. (Original) The optical information recording medium according to claim 1, further comprising:

a groove that is arranged on the second surface of the transparent substrate to form a track,

wherein at a same depth position of the recording layer, the optical density of an area of the recording layer corresponding to the groove is lower than the optical density of other area.

7. (Original) The optical information recording medium according to claim 1, further comprising:

a groove that is arranged on the second surface of the transparent substrate to form a track,

wherein the recording layer includes areas having different optical densities at a same depth position, and

an area having a lower optical density is arranged at a nearer position to the groove than an area having a higher optical density.

8. (Previously Presented) An optical information recording medium comprising:

a transparent substrate having a first surface and a second surface;

a recording layer that contains regions of differing optical density and that is arranged on the first surface of the transparent substrate,

wherein

a hologram is recorded in the recording layer when a signal light and a reference light are incident from an incident side opposite to the transparent substrate,

a region in the recording layer, in which the hologram is recorded, is conical, and

an optical density of a part of the recording layer corresponding to the signal light decreases from the incident side toward the transparent substrate, and an optical density of a remaining part of the recording layer is uniform; and

a reflection layer arranged on the second surface of the transparent substrate.

9. (Previously Presented) An optical information recording medium comprising:

a transparent substrate having a first surface and a second surface;

a recording layer that contains regions of differing optical density and that is arranged on the first surface of the transparent substrate,

wherein

a hologram is recorded in the recording layer when a signal light and a reference light are incident from an incident side opposite to the transparent substrate,

a region in the recording layer, in which the hologram is recorded, is

conical,

the recording layer includes a high optical density layer and a low optical

density layer corresponding to the signal light, and

the high optical density layer is arranged on the incident side relative to

the low optical density layer; and

a reflection layer arranged on the second surface of the transparent substrate.

10. (Withdrawn) A method of manufacturing an optical information recording

medium that includes a recording layer in which a hologram is recorded and a

transparent substrate that has a first surface and a second surface, the method

comprising:

depositing a first recording film on the first surface of the transparent substrate;

and

depositing a second recording film having a higher optical density than the first

recording film on the first recording film.

11. (Withdrawn) A method of manufacturing an optical information recording

medium that includes a recording layer in which a hologram is recorded and a

transparent substrate that has a first surface and a second surface, the method

comprising:

depositing the recording layer on the first surface of the transparent substrate;

and

irradiating a light to decrease an optical density on the recording layer from a side of the second surface of the transparent substrate.

12. (Withdrawn) A method of manufacturing an optical information recording medium that includes a recording layer in which a hologram is recorded and a transparent substrate, the method comprising:

depositing the recording layer on a surface of the transparent substrate; and

doping a sensitizer into the recording layer from a light incident side.

13. (Previously Presented) A method of recording information in an optical information recording medium, the method comprising:

selecting an optical information recording medium, the medium comprising:

a transparent substrate having a first surface and a second surface;

a recording layer that contains regions of differing optical density and that is arranged on the first surface of the transparent substrate,

wherein

a hologram is recorded in the recording layer when a signal light and a reference light are incident from an incident side opposite to the transparent substrate,

a region in the recording layer, in which the hologram is recorded, is conical, and

an optical density of the recording layer corresponding to the signal

light decreases from the incident side toward the transparent substrate;

and

a reflection layer arranged on the second surface of the transparent

substrate; and

recording the hologram in the recording layer by irradiating the optical information

recording medium with the signal light and the reference light through a lens, wherein

the optical density S(z) at a depth z in the recording layer is within a range expressed as

$$0.5 \times \frac{S_0}{r_0^2} \left(r_0 - \frac{A/n_1}{\sqrt{1 - \left(A/n_1 \right)^2}} z \right)^2 \leq S(z) \leq 2.0 \times \frac{S_0}{r_0^2} \left(r_0 - \frac{A/n_1}{\sqrt{1 - \left(A/n_1 \right)^2}} z \right)^2$$

where S_0 is the optical density on a surface of the incident side of the recording

layer at z=0, n_1 is a refractive index of the recording layer, A is a numerical aperture of

the lens, r_0 is a radius of a spot of the signal light on the surface of the incident side, and

z is a distance from the surface of the incident side into the recording layer.

14. (Previously Presented) A method of recording information on an optical

information recording medium, the method comprising:

selecting an optical information recording medium, the medium comprising:

a transparent substrate having a first surface and a second surface;

a recording layer that contains regions of differing optical density and that

is arranged on the first surface of the transparent substrate,

wherein

a hologram is recorded in the recording layer when a signal light

and a reference light are incident from an incident side opposite to the

transparent substrate,

a region in the recording layer, in which the hologram is recorded,

is conical,

an optical density of the recording layer corresponding to the signal

light decreases from the incident side toward the transparent substrate,

a reflection layer arranged on the second surface of the transparent

substrate, and

a groove that is arranged on the second surface of the transparent

substrate to form a track; and

recording the hologram in the recording layer by irradiating the optical information

recording medium with the signal light and the reference light through a lens,

wherein the optical density $S(r, z)$ at a predetermined position in the recording

layer is within a range expressed as

$$0.5 \times \frac{S_0}{r_0^2}\left(r_0 - \frac{A/n_1}{\sqrt{1-\left(A/n_1\right)^2}}z\right)^2 \exp(\frac{2r^2}{r_0^2}) \leq S(r,z) \leq 2.0 \times \frac{S_0}{r_0^2}\left(r_0 - \frac{A/n_1}{\sqrt{1-\left(A/n_1\right)^2}}z\right)^2 \exp(\frac{2r^2}{r_0^2})$$

where S_0 is the optical density of a center of a spot of the signal light at $r=0$ on a

surface of the incident side of the recording layer at $z=0$, n_1 is a refractive index of the

recording layer, A is a numerical aperture of the lens, r_0 is a radius of the spot of the

signal light on the surface of the incident side, r is a distance from the center of the spot

in a direction across the track, and z is a distance from the surface of the incident side

into the recording layer.

15. (Previously Presented) The optical information recording medium according

to claim 1, wherein the hologram is recorded in the recording layer by a polarized

collinear holographic method.

16. (Previously Presented) The optical information recording medium according

to claim 8, wherein the hologram is recorded in the recording layer by a polarized

collinear holographic method.

17. (Previously Presented) The optical information recording medium according

to claim 9,

wherein the hologram is recorded in the recording layer by a polarized collinear

holographic method.

18. (Previously Presented) The method of recording information in an optical

information recording medium according to claim 13, wherein the hologram is recorded

in the recording layer by a polarized collinear holographic method.

19. (Previously Presented) The method of recording information in an optical

information recording medium according to claim 14, wherein the hologram is recorded

in the recording layer by a polarized collinear holographic method.

20. (New) The optical information recording medium according to claim 1, wherein the optical density S(z) at a depth z in the recording layer is within a range expressed as

$$0.5 \times \frac{S_0}{r_0^2} \left(r_0 - \frac{A/n_1}{\sqrt{1-\left(A/n_1\right)^2}} z \right)^2 \leq S(z) \leq 2.0 \times \frac{S_0}{r_0^2} \left(r_0 - \frac{A/n_1}{\sqrt{1-\left(A/n_1\right)^2}} z \right)^2$$

where S_0 is the optical density on a surface of the incident side of the recording layer at z=0, n_1 is a refractive index of the recording layer, A is a numerical aperture of a lens, r_0 is a radius of a spot of the signal light on the surface of the incident side, and z is a distance from the surface of the incident side into the recording layer.

21. (New) The optical information recording medium according to claim 1, further comprising:

a groove that is arranged on the second surface of the transparent substrate to form a track, wherein

the optical density S(r, z) at a predetermined position in the recording layer is within a range expressed as

$$0.5 \times \frac{S_0}{r_0^2} \left(r_0 - \frac{A/n_1}{\sqrt{1-\left(A/n_1\right)^2}} z \right)^2 \exp(\frac{2r^2}{r_0^2}) \leq S(r,z) \leq 2.0 \times \frac{S_0}{r_0^2} \left(r_0 - \frac{A/n_1}{\sqrt{1-\left(A/n_1\right)^2}} z \right)^2 \exp(\frac{2r^2}{r_0^2})$$

where S_0 is the optical density of a center of a spot of the signal light at r=0 on a surface of the incident side of the recording layer at z=0, n_1 is a refractive index of the

recording layer, A is a numerical aperture of a lens, r_0 is a radius of the spot of the signal light on the surface of the incident side, r is a distance from the center of the spot in a direction across the track, and z is a distance from the surface of the incident side into the recording layer.

22. (New) The optical information recording medium according to claim 1, wherein the recording layer contains an initiator that absorbs light and initiates a polymerization reaction, and the initiator is bis (2,6-difluoro-3-pyrrole phenyl) titanocene.

23. (New) The optical information recording medium according to claim 1, wherein the recording layer contains an initiator that absorbs light and initiates a polymerization reaction, and a content of the initiator is 0.1 to 5.0 wt%.